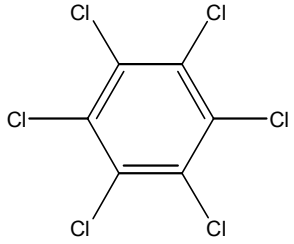
HEXACHLOROBENZENE
CAS No. 118-74-1
First Listed in the *Third Annual Report on Carcinogens*



CARCINOGENICITY

Hexachlorobenzene is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity in experimental animals (IARC S.4, 1982; IARC S.7, 1987). When administered in the diet, hexachlorobenzene induced liver tumors in female rats and mice of both sexes and hepatomas, liver hemangioendotheliomas, and thyroid adenomas in hamsters of both sexes (IARC V.20, 1979; Smith & Cabral, 1980).

There is inadequate evidence for the carcinogenicity of hexachlorobenzene in humans. Hepatocellular carcinoma has been associated with porphyria resulting from consumption of grain treated with hexachlorobenzene (IARC S.7, 1987). An IARC Working Group reported that although there was no case report or epidemiological study available to evaluate the carcinogenicity of hexachlorobenzene in humans, it should be regarded as if it presented a carcinogenic risk to humans (IARC V.20, 1979).

PROPERTIES

Hexachlorobenzene is a white solid which is insoluble in water, and is soluble in benzene, chloroform, and ether. Under most environmental conditions, it has a very low degradation rate. When heated to decomposition, hexachlorobenzene emits highly toxic fumes of hydrochloric acid and other chlorinated compounds. Technical-grade hexachlorobenzene is available as wettable powder, liquid, and dust formulations.

USE

Currently in the United States, there are no commercial uses of hexachlorobenzene as an end-product. Hexachlorobenzene was used primarily as a pesticide, an industrial chemical, and is a by-product of many chemical and pesticide manufacturing processes. It was also used as a chemical intermediate in dye manufacture, in the synthesis of other organic chemicals, and as a wood preservative. Hexachlorobenzene forms as an impurity during the synthesis of several herbicides and pesticides, including the herbicide dimethyl tetrachloro-terephthalate and the pesticide pentachloronitrobenzene (IARC V.20 1979).

PRODUCTION

Since 1982, hexachlorobenzene has not been produced commercially in the United States, but imports in 1982 totalled 38,000 lb (SRI, 1987). NCI reported that hexachlorobenzene is not now imported or produced commercially in the United States. Import/export values for hexachlorobenzene and DDT (combined) are available; but volumes for each individual compound are not available (NTDB 1995).

The 1979 TSCA Inventory identified two companies producing 5.5 million lb of hexachlorobenzene and one company importing 5,500 lb in 1977, with some site limitations (TSCA, 1979). Hexachlorobenzene is produced as a by-product or impurity in the manufacture of several chlorinated solvents (e.g., tetrachloroethylene, trichloroethylene, carbon tetratchloride); other chlorinated compounds (e.g., vinyl chloride); and several pesticides (e.g. PCNB, DCPA, PCP). It is also formed during the production of atrazine, propazine, simazine, and mirex (USHHS 1996). Currently there are two manufacturers that produce haxachlorobenzene for on-site use and processing. Five other manufacturers produce hexachlorobenzine as a by-product or impurity (TRI93 1995).

Reports indicated that production of hexachlorobenzene in the United States ended in 1976, although EPA indicated that from 1975 through 1977 three producers and importers in three regions reported domestic production of 3.7 million lb of hexachlorobenzene and imports of 3,800 lb. Commercial production of hexachlorobenzene in the United States was first reported in 1933 (IARC V.20, 1979).

EXPOSURE

The primary routes of potential human exposure to hexachlorobenzene are ingestion, inhalation, and dermal contact. The production and use of hexachlorobenzene as a fungicide over the past several decades and its occurrence as a by-product in the manufacture of other chemicals indicate that potential widespread human exposure may occur in both occupational and nonoccupational settings. It has been estimated that airborne emissions of hexachlorobenzene in the United States are between 46.3 thousand and 63.9 thousand lb per year. These emissions result primarily from pesticide use and the manufacture of chlorinated solvents (Chem. Eng. News, 1988a). The National Occupational Hazard Survey, conducted by NIOSH from 1972 to 1974, estimated that 4,400 workers were possibly exposed to hexachlorobenzene in the workplace. Occupations where the potential for human exposure exists include fungicide application, organic chemical synthesis, synthetic rubber production, seed disinfection, pesticide production, and wood preservation. Additionally, exposure to hexachlorobenzene may possibly occur as a result of its presence in wastes from pesticide manufacture; where the waste is trucked, hexachlorobenzene contaminates the ground and exposes grazing cattle around dumps and along roads (NIOSH, 1976).

Currently, hexachlorobenzene is released into the environment through industrial release. Hexachlorobenzene is among the most persistent environmental pollutants because of its relative stability and resistance to degradation. Environmental half-life estimates range from 0.63 year in tropical/subtropical regions, to 1.94 years in temperate/boreal regions, to 6.28 years in polar regions. Half-life value of hexachlorobenzene in surface water is estimated to range from 2.7 to 5.7 years and in groundwater is estimated to range from 5.3 to 11.4 years. Hexachlorobenzene will significantly bioaccumulate in both terrestrial and aquatic food chains.

EPA's monitoring of human adipose tissue collected across the United States (reported in 1986) shows trace residues of hexachlorobenzene in about 76% of the population. In FDA's Total Diet Program, investigators detected hexachlorobenzene in food composites in 30 cities at levels of 0.006 to 0.040 mg/kg. The average daily intake by humans in 1973 and 1974 was calculated to be 0.04 µg/day and 0.07 µg/day, respectively. Hexachlorobenzene residues have been detected in soil, wildlife, fish, and food samples collected worldwide. In the United States, hexachlorobenzene was detected in most river water residues (2-90 µg/l) and soil residues (ranging from traces to 1,700 µg/kg) near industrialized regions. The Toxic Chemical Release Inventory (EPA) listed seven industrial facilities that produced, processed, or otherwise used hexachlorobenzene in 1996 (TRI, 1999). In compliance with the Community Right-to-Know Program, the facilities reported releases of hexachlorobenzene to the environment which were estimated to total 1,211 lb. Total air releases were 220 lb, total water releases were 274 lb, and total underground injections were 717 lb. Hexachlorobenzene is of toxicological and environmental concern because of its bioaccumulation and persistence (IARC V.20, 1979).

REGULATIONS

EPA regulates hexachlorobenzene under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Clean Water Act (CWA), Resource Conservation and Recovery Act (RCRA), and Superfund Amendments and Reauthorization Act (SARA). Under CERCLA and CWA, a reportable quantity (RQ) of 10 lb was established for hexachlorobenzene, as well as spill reporting requirements. CERCLA has proposed a RQ of 10 lb to control environmental releases of hexachlorobenzene. RCRA designated this compound as a hazardous constituent of waste and regulates its disposal. SARA placed hexachlorobenzene on a list of toxic chemicals making it subject to reporting requirements. EPA recommended an upper limit of 0.5 ppm hexachlorobenzene in fatty tissues of cattle, pigs, and sheep, but has not promulgated a tolerance. An assessment of hexachlorobenzene is proceeding under the Clean Air Act (CAA). OSHA regulates hexachlorobenzene under the Hazard Communication Standard and as a chemical hazard in laboratories. Regulations are summarized in Volume II, Table B-69.